

## CLAIMS

### WHAT IS CLAIMED IS:

1. method for separating difluoromethane from a mixture of said difluoromethane and at least one impurity, said method comprising the step of extractively distilling said mixture using dichloromethane as the extractive agent to recover a product stream of purified difluoromethane having a concentration of said impurity lower than that of said mixture.
2. The method of claim 1, wherein the step of extractively distilling produces at least one extractive agent stream comprising a mixture of said impurity and dichloromethane; and wherein said process further comprises:  
supplying at least a portion of said extractive agent stream to a fluorination reaction which produces said difluoromethane.
3. The method of claim 1, wherein the step of extractively distilling produces a side stream and a bottoms stream, said side stream comprising a mixture of dichloromethane and said impurity, said bottoms stream comprising dichloromethane and a concentration of said impurity less than that of said side stream; and wherein said method further comprises the step of:  
supplying at least a portion of said stream to a fluorination reaction which produces said difluoromethane.
4. The method of claim 1, wherein said impurity is a chlorinated impurity having the formula:
$$\text{CH}_w\text{Cl}_y\text{X}_z$$
wherein each X is an independently selected halogen,  $y \geq 1$  and  $w+y+z=4$ .
5. The method of claim 4, wherein X is fluorine.
6. The method of claim 4, wherein said chlorinated impurity is selected from the group consisting of chlorofluoromethane, chloromethane, chlorodifluoromethane, dichlorodifluoromethane and combinations of two or more thereof.

7. The method of claim 6, wherein said chlorinated impurity is selected from the group consisting of dichlorodifluoromethane, chloromethane and combinations thereof.
8. The method of claim 1, wherein the concentration of impurity in the recovered HFC-32 is no greater than about 50 ppm by weight.
9. The method of claim 8, wherein the concentration of impurity in the recovered HFC-32 is no greater than about 10 ppm.
10. The method of claim 1, wherein the yield of HFC-32 is no less than about 80%.
11. The method of claim 1, wherein the step of extractively distilling is conducted at a pressure of about 1 to about 15 bars.
12. A method for preparing a fluorinated compound comprising the steps of:
  - fluorinating a chlorinated organic compound to produce a reactor stream comprising a mixture of a fluorinated compound and at least one impurity;
  - feeding said mixture to a distillation unit;
  - feeding an extractive agent to said distillation unit, wherein said extractive agent is said chlorinated organic compound;
  - operating said distillation unit under conditions sufficient to distill a product stream comprising said fluorinated compound and a concentration of said impurity less than that of said reactor stream;
  - withdrawing a side stream from said distillation unit, said side stream comprising said impurity and said extractive agent;
  - withdrawing a bottoms stream from said distillation unit, said bottoms stream comprising said extractive agent and a concentration of said impurity less than that of said side stream;
  - supplying the fluorination reaction with at least a portion of said side stream; and
  - recycling at least a portion of said bottoms stream to said distillation unit.

13. The method of claim 12, wherein said extractive agent is selected from the group consisting of dichloromethane, trichloroethylene, tetrachloroethylene, and 1,1,1,3,3-pentachloropropane.
14. The method of claim 12, where said fluorinated compound is selected from the group consisting of difluoromethane, 1,1,1,2-tetrafluoroethane, pentafluoroethane, and 1,1,1,3,3-pentafluoropropane.
15. The method of claim 12, wherein said extractive agent is dichloromethane and said fluorinated compound is difluoromethane.
16. The method of claim 12 wherein the step of extractively distilling is conducted at a pressure of about 1 to 15 bars.
17. A system for the preparation of a fluorinated compound comprising:  
a reactor adapted to receive a chlorinated organic compound from at least one source and a fluorination agent for fluorinating said chlorinated organic compound, said reactor adapted to facilitate fluorination of said chlorinated organic compound and to produce a reactor stream comprising a mixture of a fluorinated compound and an impurity;  
a first conduit for feeding said mixture to a distillation unit;  
a distillation unit configured to receive said mixture and an extraction agent from at least one source, said distillation unit being adapted to facilitate extractive distillation of said mixture to produce an overheads stream, a side stream, and a bottoms stream, said overheads stream comprising said fluorinated compound and having a lower concentration of chlorinated impurities than said reactor stream, said side stream comprising said extractive agent and said chlorinated impurity, said bottoms stream comprising said extractive agent and having a lower concentration of said chlorinated impurity than said side stream;  
a second conduit for supplying at least a portion of said side stream to said fluorination reactor; and

a third conduit for supplying at least a portion of said bottoms stream to said distillation unit.

18. The system of claim 17, further comprising:  
a device for adjusting the flow rates through said first conduit, said second conduits or a combination thereof.
19. The system of claim 17, wherein said device is a valve in said third conduit for diverting a portion of the bottoms stream from said distillation unit to said fluorination reactor.